Chemistry Equations Revision

Production of Materials	
Bromine Water Experiment	
	Formation of Bromine Water: $Br_{2(aq)} + H_2O_{(l)} \rightleftharpoons HOBr_{(aq)} + Br^-_{(aq)} + H^+_{(aq)}$ Reaction: $C_6H_{12(l)} + HOBr_{(aq)} \longrightarrow C_6H_{12}BrOH_{(aq)}$
Dehydration of Ethylene	
	$CH_3CH_2OH_{(g)} \xrightarrow{H_2SO_4 \text{ catalyst}} C_2H_{4(g)} + H_2O_{(l)}$
Addition of Water to Ethylene	
	$C_2H_{4(g)} + H_2O_{(l)} \xrightarrow{\text{dilute } H_2SO_4} CH_3CH_2OH_{(g)}$
Combustion of Ethanol	
	$C_2H_5OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(g)} + \text{Heat}$
Fermentation of Glucose	
	$C_6H_{12}O_{6(aq)} \xrightarrow{\text{yeast}} 2C_2H_6O_{(aq)} + 2CO_{2(g)} + \text{Heat}$
Dry Cell Half-Equations	
	At the Anode: $Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e^-$ At the Cathode: $NH_4^+{}_{(aq)} + MnO_{2(s)} + H_20_{(l)} \rightarrow Mn(OH)_{3(s)} + NH_{3(aq)}$

Lithium Cell Half-Equations	
	<u>At the Anode:</u> $Li_{(s)} \rightarrow Li^{+}_{(soln)} + e^{-}$ <u>At the Cathode:</u> $Mn^{IV}O_{2(s)} + Li^{+}_{(soln)} + e^{-} \rightarrow LiMn^{III}O_{2(s)}$ $(Li^{+}Mn^{III}O_2)$
<u>The Acidic Environment:</u>	
Acid Reaction Rules	
	Acid + Base → Salt + Water Acid + Metal → Salt + Hydrogen gas Acid + Carbonate → Salt + Water + Carbon dioxide gas
Reaction between carbon dioxide and water	
	<u>Formation of Carbonic Acid:</u> $CO_{2(g)} + H_2O_{(l)} \longleftrightarrow H_2CO_{3(aq)}$ (Carbonic Acid)
Causes of Sulfur Dioxide	
	<u>Bacterial Decomposition:</u> $2H_2S_{(g)} + 3O_{2(g)} \longrightarrow 2SO_{2(g)} + 2H_2O_{(l)}$ <u>Combustion of Fossil Fuels:</u> $4FeS_{2(s)} + 11O_{2(g)} \longrightarrow 2Fe_2O_{3(s)} + 8SO_{2(g)}$ <u>Smelting of Sulfide Ores:</u> $2ZnS_{(s)} + 3O_{2(g)} \longrightarrow ZnO_{(s)} + 2SO_{2(g)}$
Causes of oxides of nitrogen	
	<u>Lightning:</u> $N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$

	<u>Sunlight:</u> $2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$ <u>Combustion of Fossil Fuels:</u> $N_{2(g)} + O_{2(g)} \xrightarrow{\text{High Temp}} 2NO$ $NO_{2(g)} + H_2O \longrightarrow H_2NO_3$
Formation of Acid Rain	
	$2NO_{2(g)} + H_2O_{(l)} \longrightarrow HNO_2 + HNO_3$ $SO_{2(g)} + H_2O_{(l)} \longrightarrow H_2SO_{3(aq)}$ $SO_{3(g)} + H_2O_{(l)} \longrightarrow H_2SO_{4(aq)}$
Ionisation of HCl	
	$HCl + H_2O \longrightarrow Cl^- + H_3O^+$
Ionisation of Citric Acid	
	$C_6H_8O_7 + H_2O \longleftrightarrow C_6H_7O_7^- + H_3O^+$ $C_6H_7O_7^- + H_2O \longleftrightarrow C_6H_6O_7^{2-} + H_3O^+$ $C_6H_6O_7^{2-} + H_2O \longleftrightarrow C_6H_5O_7^{3-} + H_3O^+$
Ionisation of Acetic Acid	
	$CH_3COOH + H_2O \longleftrightarrow CH_3COO^- + H_3O^+$

Chemical Monitoring & Management	
Production of Ammonia	
	Haber Process $N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$ $?H = -92\ kJ\ mol^{-1}$.
Breaking of oxygen double bond	
	$O_{2(g)} \rightarrow 2O_{(g)}$ $?H = 498\ kJ\ mol^{-1}$
Breaking of ozone bond	
	$O_{3(g)} \rightarrow O_{2(g)} + O_{(g)}$ $?H = 106\ kJ\ mol^{-1}$
Breaking Down of CFC's	
	CCl_3F + UV Light $\rightarrow$ Cl + CCl_2F
Destruction of Ozone	
	$Cl + O_3 \rightarrow ClO + O_2$
Final Stage of Ozone Depletion:	
	$ClO + O \rightarrow O_2 + Cl$

Shipwrecks	
Passivating Metal	
	<u>Aluminium</u>: $4Al_{(s)} + 3O_{2(g)} \rightarrow 2Al_2O_{3(s)}$
Process of Rusting:	
	<u>At the Anode:</u> $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$ At the Cathode: $O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$ <u>Two combined:</u> $Fe^{2+}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$ <u>Oxidation of Iron(II) hydroxide:</u> $4Fe(OH)_2(s) + O_2(g) \rightarrow 2(Fe_2O_3.H_2O)(s) + 2H_2O(l)$
Galvanising	
	$Zn^{2+} + 2OH^- \rightarrow Zn(OH)_2(s)$ $Zn(s) + Fe^{2+}(aq) \rightarrow Zn^{2+} + Fe(s)$
Bacterial Corrosion	
	<u>Reduction of Sulfate:</u> $SO_4^{2-}(aq) + 5H_2O(l) + 8e^- \rightarrow HS^-(aq) + 9OH^-(aq)$ <u>At the Anode:</u> $4Fe(s) \rightarrow 4Fe^{2+}(aq) + 8e^-$ <u>Overall Equation:</u> $4Fe(s) + SO_4^{2-}(aq) + 5H_2O(l) \rightarrow 4Fe^{2+}(aq) + HS^-(aq) + 9OH^-(aq)$

	Forming of Iron Hydroxide: $4Fe^{2+}(aq) + HS^{-}(aq) + 7OH^{-}(aq) \rightarrow FeS(s) + 3Fe(OH)_2(s) + H_2O(l)$ Overall Process: $4Fe(s) + SO_4^{-}(aq) + 4H_2O(l) \rightarrow FeS(s) + 3Fe(OH)_2(s) + 2OH^{-}(aq)$
Rust in acidic environments	
	$O_2(g) + 4H^{+}(aq) + 4e^{-} \rightarrow 2H_2O(l)$
Insoluble Hydroxy Chlorides:	
	The Danger of them: $Cu(OH)Cl(s) + H_2O(l) \rightarrow Cu(OH)_2(s) + HCl(aq)$ $Fe(OH)Cl(s) + H_2O(l) \rightarrow Fe(OH)_2(s) + HCl(aq)$ $4Fe(OH)Cl(s) + 6H_2O(l) + O_2(g) \rightarrow 4Fe(OH)_3(s) + 4HCl(aq)$ Removal of them by electrolysis: At the Cathode: $Fe(OH)_2(s) + 2e^{-} \rightarrow Fe(s) + 2OH^{-}(aq)$ & $Fe(OH)Cl(s) + 2e^{-} \rightarrow Fe(s) + OH^{-}(aq) + Cl^{-}(aq)$ At the Anode: $4OH^{-}(aq) \rightarrow O_2(g) + 2H_2O(l) + 4e^{-}$